Plate 4: Map Showing Thickness and Geology of the Potomac Formation City of Alexandria and Vicinity

By Tony Fleming, March 2008

The early Cretaceous Potomac Formation crops out extensively in ravines, hillsides, and road cuts in the highlands west of Old Town, and is present in the subsurface everywhere except in a small strip in the extreme western part of the city, where it has been removed by erosion. At many places in the uplands, the Potomac Formation is concealed beneath a veneer of old river terraces and other surficial deposits of Tertiary and Pleistocene age (see plate 5); beneath Old Town and Del Ray, it is covered by thick late Pleistocene-Recent alluvial deposits of the Potomac River. This map shows the geology of the Potomac Formation throughout the city—as if the younger deposits that conceal it were stripped off. This depiction of the Potomac subcrop was constructed using a combination of subsurface data from wells and geotechnical borings, along with projections from outcrops. The entire formation in Alexandria was deposited by a large river system, which included oxbow lakes; no marine, tidal, or estuarine deposits are currently recognized in the city. On this map, the Potomac Formation is divided into several informal local units, or sedimentary facies, based on a combination of gross lithologic characteristics, sedimentary structures, and stratigraphic position. Due to sparse data in some areas, some units (or parts thereof) and their relations to adjacent units are poorly known. A more complete account of the Potomac Formation, this map, and how it was compiled can be found in the expanded explanation of plate 4.

Explanation of Map Symbols

Boundary between map units, approximately located. May be broadly transitional

Contour showing line of equal thickness of the Potomac Formation, contour interval 100 feet

Fault, queried where tentatively located. U-upthrown side, D-downthrown side.

Thrust fault observed in outcrop, teeth on top plate (upthrown side)

Predominant dip vector of cross beds observed in outcrop

Description of Map Units – the early Cretaceous Potomac Formation is subdivided into informal map units; each map unit typically is named after a place in the city where its main characteristics are well displayed

Speculative distribution of **Arell clay (A)** and **Chinkapin Hollow fine sandy clay (CH)** beneath Old Town and Del Ray, based on the type of material encountered at the top of the formation. Sedimentary sequences in the Potomac Formation below this part of the city are poorly known because they are covered by thick Pleistocene - Recent alluvium and do not crop out. Some old wells penetrate most or all of the formation, but few provide any lithological descriptions. And, because of the great thickness of the younger alluvial cover, only a small percentage of the many geotechnical borings in this area penetrate the top of the Potomac Formation. Relations of Potomac sediments at depth in this area to units mapped in the adjacent uplands are unclear

Shooters Hill gravel – Medium-coarse, clayey sand, commonly gravelly, derived from weathered arkosic sand and gravel. Known only from a few small, slumped outcrops and shallow borings between Ivy Hill Cemetery and Shooters Hill. Forms thin (<15 ft) erosional remnants beneath the younger river terrace gravel. Physically overlies the Arell clay, probably on a local erosional unconformity. Appears to be the youngest unit in the Potomac Formation present in the city

Arell clay – Massive lacustrine clay, commonly mottled green and red in outcrop, green- or blue-gray below the water table. Typically hard and fractured, forming steep bluffs and hillsides with many prehistoric and modern landslide scars. Core of unit ranges from 100-150 feet thick and is commonly devoid of sand, either as separate bodies or admixed with clay; lenses of clayey silt are widely present. Interbedded muddy sands are more abundant towards edges and near base of unit, mainly as thin lenses and sheets. Presumably deposited in a large oxbow lake. Unconformably overlies all other named units except Shooters Hill gravel, but may be in a lateral facies relationship to parts of the Chinquapin Hollow fine sandy clay

Chinquapin Hollow fine sandy clay – Fine to very fine sandy clay, sandy and clayey silt, organic silt, and clayey fine sand, locally with lignite layers and many cypress fragments. Commonly variegated green and brown. These lithologies are interbedded in predominantly fining-upwards local sequences at scales ranging from less than one inch to several feet. Small-scale planar cross beds are observed in some sands. Rarely contains thin layers of fine lag gravel and granule sands. Locally contains scattered, somewhat larger bodies of massive, less sandy, gummy silty clay (c) and fine-medium clayey sand (s), which are seldom mappable over any great distance. Unit probably represents a large point bar; minimum thickness is 120 feet. Appears to unconformably overlie Winkler sand, Lincolnia silty clay, and parts of Cameron Valley sand based on map pattern, but field relations are obscure, and the unit may grade upwards from the tops of large valley-fill sands near the Four Mile Run bedrock valley, or laterally into the Winkler sand

Winkler sand – Medium to coarse, trough crossbedded arkosic to quartzose sand, locally pebbly. Feldspar in arkose is commonly weathered into clay. Cemented by purple hematite in a few places. Forms a series of channel-like bodies in the Lincolnia silty clay, concentrated in a southwest-trending belt along and east of Shirley Highway. Thickness typically 30-50 feet but locally exceeds 100 feet near Shirley Highway. Apparently deposited in a channel system on the Lincolnia floodplain

Lincolnia silty clay – Massive to slabby-looking silty clay and clayey silt, locally sandy. Typically light gray-green where fresh and red-brown where weathered, but locally variegated. Small to medium sized lenses and channel like bodies of fine to medium arkosic sand are moderately common. Thickness typically 50-60 feet but may exceed 100 feet in vicinity of Beauregard Street. Fine, wavy laminations rarely visible in slabby clay. Probably overbank sediment deposited on a broad, stable floodplain. The *Barcroft diamicton* typically occurs near the base of the Lincolnia silty clay or an equivalent horizon . It contains pebbles, cobbles, and boulders up to 18 inches long embedded in a dense, massive to crudely layered, red-brown to green-gray clayey matrix with incipient soil horizonation and organic layers. Clasts include vein quartz, sandstone, and *skolithos*-bearing quartzites; some are faceted, pitted, and resemble ventifacts. Zones of diamicton are locally interbedded with silty clays and muddy sands

Cameron Valley sand – Complex of large channel sands, point bars, and overbank deposits marking inception of Potomac sedimentation. The Cameron Valley sand is divided into 4 mappable facies. Lower part of unit (Cs) consists chiefly of medium, clayey, arkosic sand and weakly-cemented sandstone that is commonly very micaceous close to the bedrock surface. Large-scale trough and planar cross beds are abundant; thin, disrupted silt and clay beds and clay clasts of various sizes are locally prominent. Sequences (Cg) of gravelly sand interbedded with thin to moderately thick, light colored silty clay beds are also found at places in the lower part of the unit. Large plugs of silty clay (Cc) occur along Four Mile Run near the base of the unit, and at higher horizons in the Cameron Valley; some of the latter may be equivalent to the Lincolnia silty clay. Upper part of unit (Cv) is uniquely associated with the Cameron and Four Mile Run bedrock valleys and consists of large bodies of channel sands interbedded with increasing numbers of silty-clay bodies of various sizes upward in the section. The boundaries between these facies are generalized. Total thickness ranges up to 125 feet at most places, except over parts of the Cameron and Four Mile Run bedrock valleys, where it exceeds 200 feet.